REMARKS

This is a reply to the Office Action dated August 24, 2011. Applicant thanks the Examiner for carefully considering the application.

Status of Claims

Claims 1, 3-13, 16-27, 29-33, 37 and 38 are pending in the above-referenced patent application. Claims 1, 31, and 32 are independent. Claims 1, 3-13, 16-27, 29-33, 37 and 38 are rejected as being anticipated under 35 U.S.C. § 103(a) over prior art.

Claim Amendments

Claims 1, 31 and 32 are amended for clarification. Claims 2, 14-15, 23-26, 28, 34-36, and 39-41 are canceled. No new matter is added.

35 U.S.C. § 103(a) – Claims 1, 3-13, 16-27, 29-33, 37 and 38

Claims 1, 3, 6-13, 16-24, and 31-33, and 37-38 were rejected under 35 U.S.C. §103(a) as being obvious over EP 0680810 A1 ("EP 810") in view of admitted state in the art (ASA) and "Boiling" and in further view of U.S. Patent 430705 by Kelso, Jr. ("Kelso"). Applicant respectfully traverses these rejections because, for at least the following reasons, EP 810 does not disclose, teach or suggest all of the claimed limitations described in the current application.

First, as amended, independent claim 1 now requires, in part,

> preheating a working solution comprising acetic anhydride to a temperature above the atmospheric boiling point of the working solution *in a range of 170 to 200°C* to form a working solution at a super hot temperature, wherein sufficient pressure is applied throughout the preheating step to ensure the working solution is maintained in a liquid phase (emphasis added);

and independent claims 31 and 32 also require, in part,

> preheating a working solution comprising acetic anhydride to a temperature above the atmospheric boiling point of the working solution

> *in a range of 170 to 200°C* to form a working solution at a super hot temperature, at an elevated pressure sufficient to maintain the working solution in the liquid phase (emphasis added).

Second, independent claim 1 now also requires, in part,

> contacting a wood or wood based material with the working solution at said super hot temperature and at an elevated pressure such that the working solution is maintained in the liquid phase, to cause impregnation of the liquid phase solution into the wood or wood based material *and to react the liquid phase working solution within the wood or wood based material* (emphasis added);

and independent claims 31 and 32 now require, in part,

> contacting a wood or wood based material with the working solution at said super hot temperature and said elevated pressure to cause impregnation of the solution into the wood or wood based material *and to react the liquid phase working solution within the wood or wood based material* (emphasis added);

Applicant respectfully maintains that EP 810 does not teach, suggest, or motivate this simultaneous one-step reaction of wood impregnation and complete acetylation reaction as claimed in the current application. In the current application, as reflected in the amended claims, the acetylation reaction takes place within the wood or wood based product during the impregnation step. *See* p. 8, ln. 1-4. In contrast, EP 810 discloses a wood impregnation step that is separate from the acetylation step. *See* EP 810 p. 3, ln. 14-33. As described on p.3, ln. 14-23 and further supported by the accompanying drawing in *Fig.*, the wood *impregnation* step of EP 810 is performed by using a pressure in the range of 2-15 bar or a vacuum after the addition of acetic anhydride solution to the wood, and the solution is heated to a temperature *in the range of 30-150°C*. Subsequent to the impregnation process, the *acetylation reaction* in the wood can be carried out in two alternative options: (1) the wood is first surrounded with hot liquid acetic anhydride, and afterwards drained of excessive acetic anhydride; or (2) the wood is first drained of excessive acetic anhydride, and afterwards heated. *See* EP 810, p. 3, lines 24-28; *Fig.* Under either option, the acetylation reaction step in EP 810 is *subsequent* to the impregnation step and

the temperature of the reaction is *in the range of 30-150°C*. *See* EP 810, p. 3, lines 24-33; *Fig.*

During a telephone interview with the Examiner on January 11, 2012, the Examiner noted that EP 810 discloses a two-step process. However, the Examiner raised a concern that it may be inherent in EP 810 that *some* of the impregnated acetic anhydride in the wood was undergoing the acetylation reaction process as well during the impregnation step, albeit incomplete, because the Examiner believed that the temperature disclosed in EP 810 is close in range to the temperature disclosed in the current application such that they overlap.

Applicant respectfully submits that the process claimed in the current application is distinguished from the process disclosed in EP 810. There is no overlap of the temperature disclosed in EP 810 and the temperature claimed in the current application. EP 810 requires a two-step process because its reaction temperature is maintained in the range of 30-150°C. In contrast, the current application is a truly continuous one-step reaction that can only be achieved by preheating the working solution under sufficient pressure to an elevated temperature above the atmospheric boiling point of the working solution, *most preferably in a range of 170 to 200°C*, and maintaining such temperature throughout the process to cause a rapid, single-step simultaneous impregnation *and complete acetylation reaction* in the wood. *See* p. 5, ln. 17-33; p. 6, ln. 1-4; p. 7, ln. 31-32; p. 8, ln. 1-4; p. 10, ln. 4-19.

As shown in Experiment 1 on pp. 11-14, when the temperature of the working solution is preheated to a temperature above the atmospheric boiling point of the working solution in the range of 170 to 200°C, a complete acetylation results. Table 1 on p. 13 provides the data points of various acetylation reactions (column 1, Treatments 2 through 19) and their respective parameters, and Table 2 on p. 14 provides the correlating data points of the resulting net uptake, gross uptake, pressure and vacuum kickback of all the experimental reactions conducted in Table 1.

Here it is shown that for a total reaction time of only between 27 minutes to 100 minutes (Table 1, column 10 entitled "Including recovery of by-products" on p. 13), when the working solution is preheated to a temperature above the atmospheric boiling point of the working solution in the range of 170-200°C (Table 1, column 2 entitled "Solution Temperature Before" on

p. 13), a generally high yield of net uptake of acetyl group is obtained in only one continuous reaction (Table 2, column 2 entitled "Net Uptake After Treatment (kg/m3)" on p. 14). For example, in Treatment 5, it is shown that when the temperature of the working solution is preheated to 200°C (Table 1, columns 2), the treated wood obtains a net uptake of 109.39 kg/m3 after a total of 80 minutes (Table 2, column 2; Table 1, column 10). Similarly, in Treatments 8-10, 14 and 16-17, it is shown that when the temperature of the working solution is preheated to 190°C, the treated wood obtains a net uptake of 128.99 kg/m3 after a total of 79 minutes, 155.38 kg/m3 after a total of 67 minutes, 129.51 kg/m3 after a total of 41 minutes, 132.38 kg/m3 after a total of 41 minutes, 113.40 kg/m3 after a total of 43 minutes, and 108.94 kg/m3 after a total of 27 minutes, respectively.

In Experiment 3 on pp. 16-17, 10% succinic anhydride is added to the acetic anhydride to reduce charring of the treated wood. Table 4 on p. 17 illustrates the data points of a number of experimental reactions using various types of wood, and Table 5 on p. 17 provides the resulting weight gain of the experimental reactions conducted in Table 4. The data points of Tables 4 and 5 provide further support that when the acetic anhydride working solution is preheated to a temperature above the atmospheric boiling point of the working solution in the range of 170 to 200°C, a complete impregnation and acetylation reaction occurs in one step. Here, for a total reaction time of between 47.5 minutes to 59 minutes (Table 4, column 11 entitled "Total Time (minute) Including Recovery" on p. 17), when the working solution is preheated to a temperature in the range of 180 to 200°C (Table 4, column 4 entitled "Solution Temperature Before (°C)" on p. 17), a weight gain of between 21% to 29% is obtained (Table 5, column 2 entitled "Weight Gain" on p. 17). Experiment 5 on pp. 18-19 uses various concentrations of acetic anhydride working solution. Tables 8 and 9 on p. 19 demonstrate that when 100% acetic anhydride working solution is preheated to 190°C, 28.4% weight gain is obtained. A weight gain after treatment indicates a complete acetylation reaction and the treated wood has replaced the smaller size hydroxyl group in the wood with the larger size acetyl group. *See* p. 8, ln. 11-14. A limit of 28% weight gain is very close to the maximum theoretical reaction by acetylation. *See* p. 14, ln. 9-10. Thus, the process claimed in the current application yields results that are very close to the

maximum theoretical yield, and as supported by the detailed written description, this is due to preheating the working solution to a temperature above the atmospheric boiling point of the working solution in the range of 170 to 200°C.

Finally, in Experiment 6, radiata pine heartwood and sapwood having different sizes were treated by preheating acetic anhydride working solution to a temperature within the range of 170-200°C. *See* pp. 20-21. In the first batch of Experiment 6, Treatment 208, the acetic anhydride working solution is preheated to 173°C. *See* p. 20, ln. 15-32. As shown on Table 10, preheating the working solution to 173°C results in a weight gain of between 26.55% to 32.64%. On the other hand, in the second batch of Experiment 6, Treatment 209, when the acetic anhydride working solution is preheated to 170°C, the treated wood obtains a weight gain of between 13.04% to 20.50%. *See* p. 21. This data further supports the claims in the current application that preheating the working solution to a temperature above the atmospheric boiling point of the working solution in the range of 170 to 200°C yields a truly one-step impregnation and complete acetylation reaction with results that are very close to the maximum theoretical yield.

Based on all of the above, Applicant respectfully submits that in contrast to the current application, EP 810 does not teach an aggressive and simultaneous one-step wood impregnation/acetylation reaction, in which the working solution is preheated to a temperature above the atmospheric boiling point of the working solution in the range of 170 to 200°C to cause a complete acetylation reaction to take place in the wood. Therefore, it would not have been obvious to a person having ordinary skill in the art to appreciate and reap the benefits of the process claimed in the current application.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant believes that the claims are in condition for allowance. Reconsideration, re-examination, and allowance of all claims are respectfully requested. If the Examiner feels that a telephone interview may help further the examination of the present application, the Examiner is encouraged to call the undersigned attorney or his associates at the telephone number listed below.

Please direct all correspondence to **Innovation Capital Law Group, LLP**, 19900 MacArthur Blvd., Suite 1150, Irvine, California 92612.

Respectfully submitted,

/Vic Lin/ 2/24/2012
Vic Lin Date
Reg. No. 43,754
Innovation Capital Law Group, LLP
19900 MacArthur Blvd., Suite 1150
Irvine, CA 92612
(949) 954-5430 – Tel
(949) 954-8528 – Fax
USPTO Customer No.: 97066